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FUTURE COMMUNICATIONS SATELLITE APPLICATIONS

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SWITCHED POINT-TO-POINT NARROWBAND COMMUNICATIONS

CHARACTERISTICS:

SMALL/LOW COST TERMINALS

SINGLE HOP COMMUNICATIONS

VOICE COMPATIBLE

FULL MESH NETWORKING

ISDN COMPATIBLE

POSSIBLE LIMITED USE OF FULL MOTION VIDEO

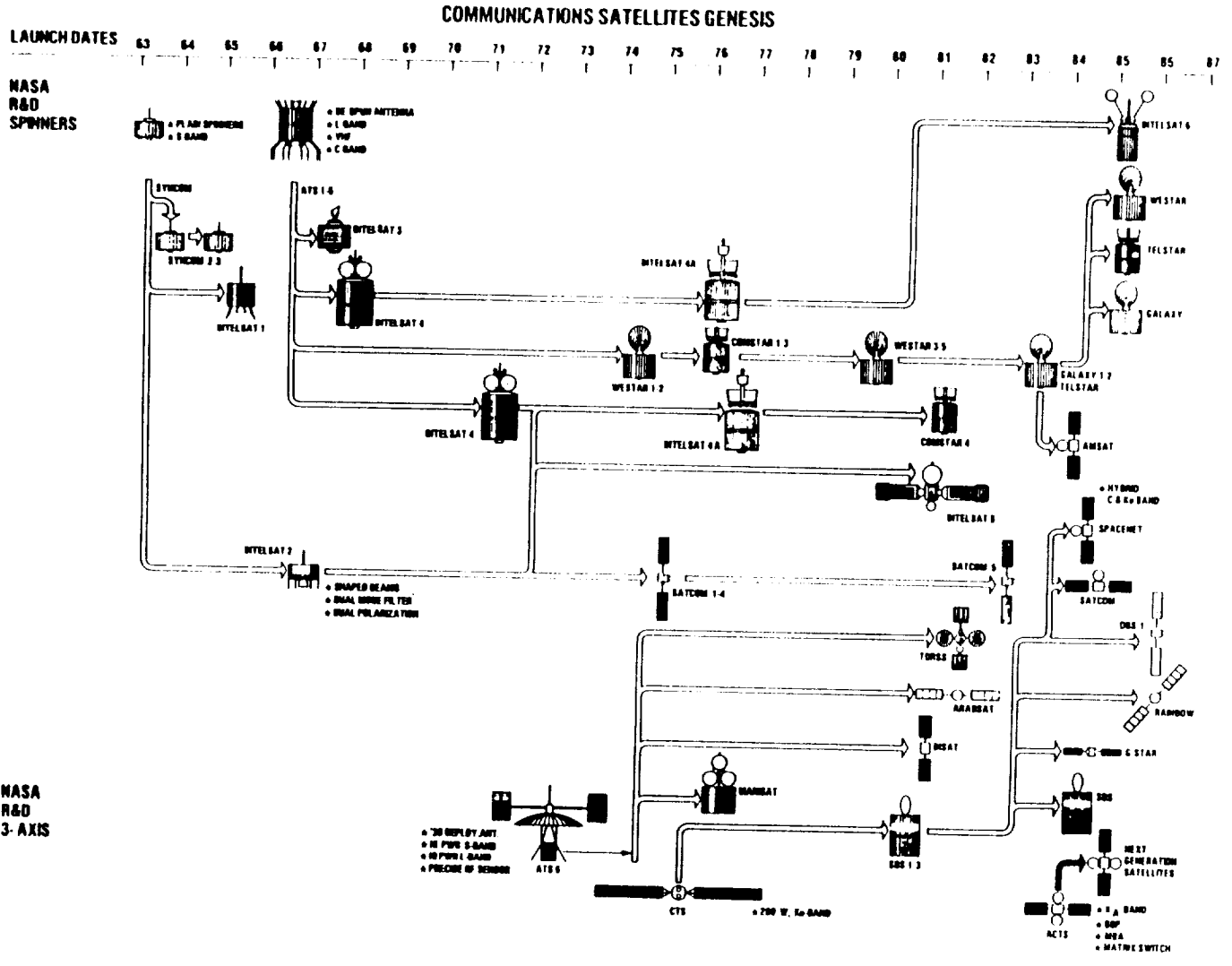
TARGET APPLICATIONS:

VOICE/DATA NETWORKS BETWEEN PLANTS AND OFFICES IN A CORPORATION

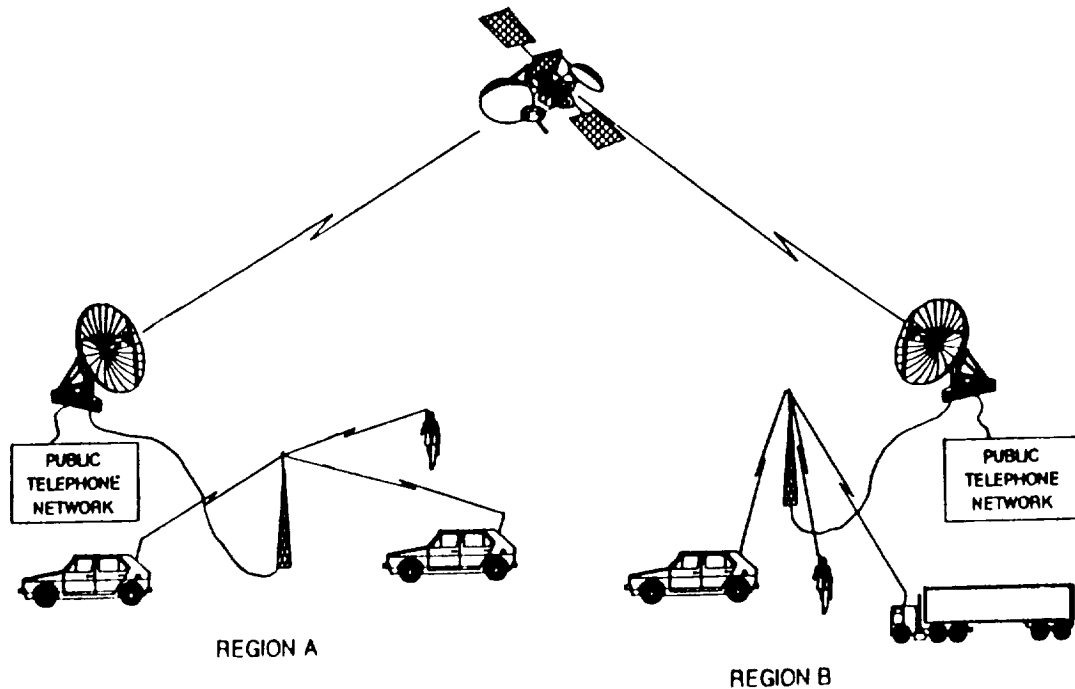
DATABASE NETWORKING FOR COMMERCIAL AND SCIENCE USERS

CELLULAR RADIO INTERNODAL VOICE/DATA NETWORKING

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CELLULAR RADIO INTERNODAL NETWORK



COMMUNICATION SATELLITES

CHARACTERISTICS COMPARISON

CURRENT

- o CONUS COVERAGE ANTENNAS
- o BENT PIPE TRANSPONDERS
- o C AND Ku BAND
- o LIMITED BANDWIDTH
- o LARGE EARTH TERMINALS
- o STAR NETWORKS

FUTURE

- o SPOT BEAM & SCANNING ANTENNAS
- o REGENERATIVE PROCESSING TRANSPONDERS
- o Ka BAND
- o UNCONGESTED
- o SMALL EARTH TERMINALS
- o MESH NETWORKS

BUSINESS/RESIDENTIAL VIDEO PHONE SERVICE

CHARACTERISTICS:

LOW COST TERMINALS LOCATED AT CABLE HEAD ENDS
TRAFFIC FROM TERMINALS SWITCHED/ROUTED THROUGH SATELLITE
SINGLE HOP TO ANY OTHER TERMINAL IN CONUS
VIDEO CAMERA REQUIRED AT EACH RESIDENCE
USES TELEPHONE CIRCUITS FOR AUDIO

ADVANTAGES:

USES EXISTING HOME TELEVISION SET AND TELEPHONES
USES EXISTING CATV DISTRIBUTION SYSTEMS
PROVIDES VALUE ADDED SERVICE FOR CABLE TV SUPPLIERS
SATELLITE & TERMINAL COSTS SPREAD OVER LARGE CUSTOMER BASE

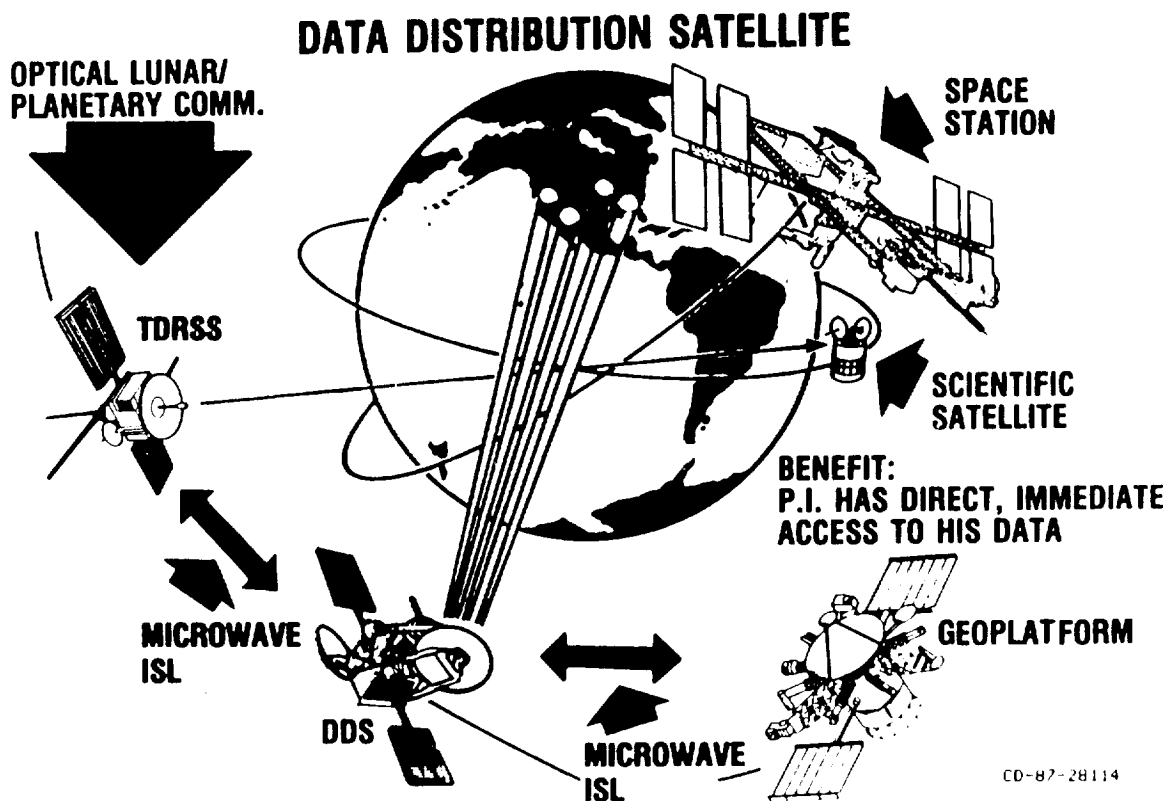
DISADVANTAGES:

REQUIRES REVERSE CHANNEL REPEATERS
MAY EVENTUALLY BE DISPLACED BY OPTICAL FIBER

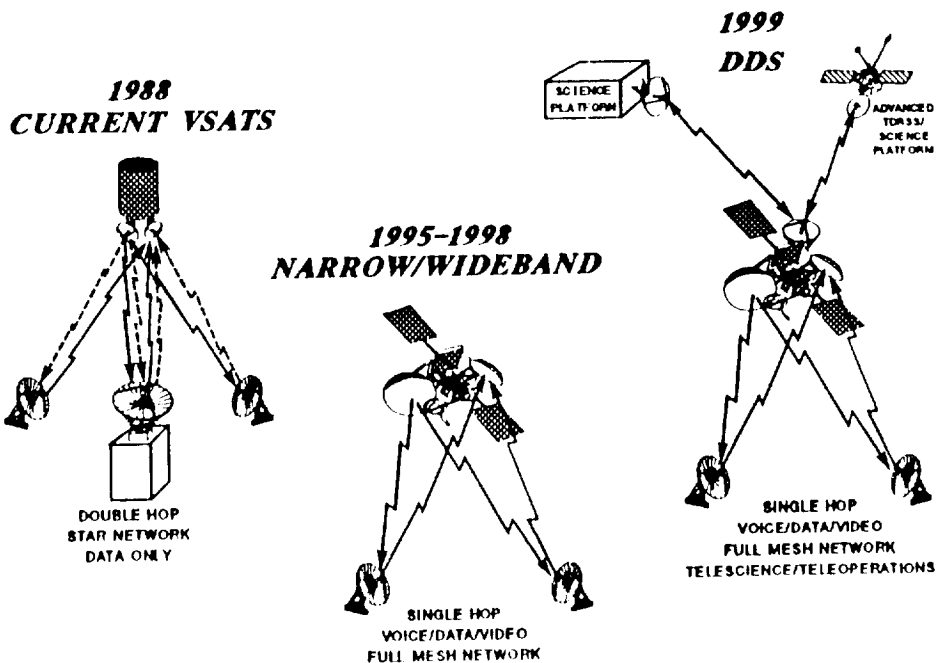
COMMUNICATION SYSTEMS CHARACTERISTICS

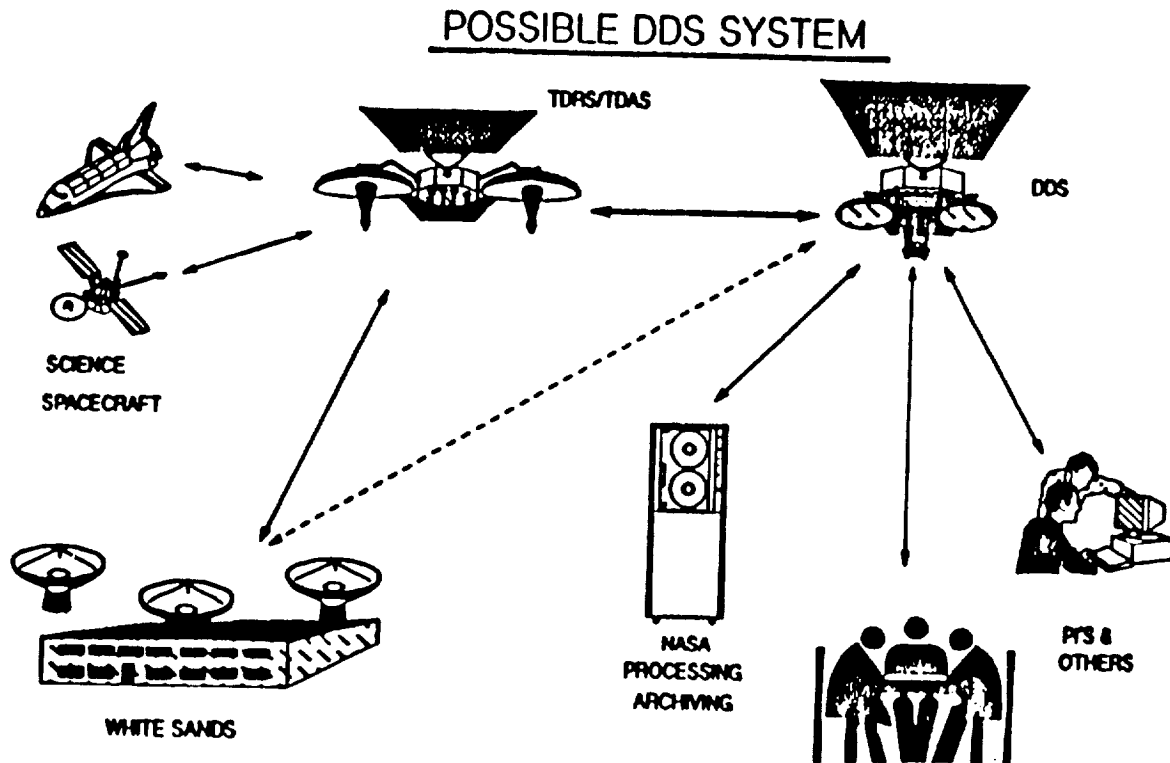
- 27.5-30.0 GHz UPLINK 17.7-20.2 GHz DOWNLINK
- TDMA WITH DAMA
- MW MATRIX SWITCH MODE
220 MSPS UPLINK 220 MSPS DOWNLINK
(NOTE-EXPERIMENTS POSSIBLE AT ANY BIT RATE AND
MODULATION IN EITHER TDMA OR FDMA FORMAT)
- BASEBAND PROCESSOR MODE
FOUR-27.5 MSPS TWO-110 MSPS DOWNLINKS
TWO-110 MSPS UPLINKS
- SMSK MODULATION IN BASEBAND PROCESSOR MODE
- $\leq 10^{-6}$ BER
- FADE MARGIN:

	<u>MWMS MODE</u>	<u>BBP MODE</u>
UPLINK	18 dB	15 dB
DOWNLINK	8 dB	6 dB
- FADE SENSING 20 AND 30 GHz DOWNLINK BEACONS
- 20 GHz TWTA
POWER 43 W
- 30 GHz FET LOW NOISE AMPLIFIER 5 dB MAX NOISE FIGURE



EVOLUTION OF OPERATIONAL SYSTEMS





CELLULAR RADIO INTERNODAL SERVICE

CHARACTERISTICS:

LOW COST TERMINAL LOCATED AT CELL ANTENNA SITE TRAFFIC FROM TERMINALS SWITCHED/ROUTED THROUGH SATELLITE SINGLE HOP TO ANY OTHER TERMINAL IN CONUS

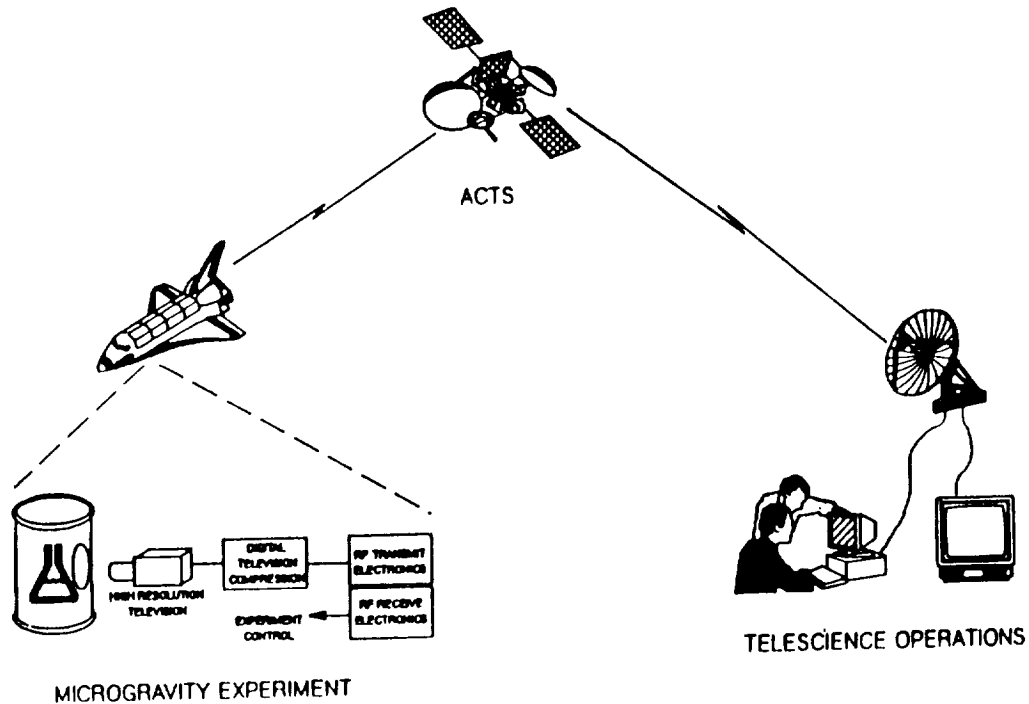
ADVANTAGES:

USES IN-PLACE MOBILE SERVICE
 TAKES ADVANTAGE OF ESTABLISHED CUSTOMER BASE/MARKET
 AVAILABILITY OF ADEQUATE BANDWIDTH/NO FREQUENCY ALLOCATION PROBLEM
 COST EFFECTIVE MOBILE RADIOS ALREADY AVAILABLE
 PROVIDES BYPASS OF TERRESTRIAL TOLL NETWORK
 DIRECT VOICE QUALITY LINK BETWEEN MOBILE USERS
 INTERCONNECTION OF CELLS IN NEWLY LICENSED RURAL AREA

DISADVANTAGES:

COMPETES WITH TERRESTRIAL TOLL SERVICES

TELESCIENCE EXPERIMENT



SWITCHED POINT-TO-POINT WIDEBAND COMMUNICATIONS

CHARACTERISTICS:

SMALL/LOW COST TERMINALS

SINGLE HOP COMMUNICATIONS

VOICE/VIDEO COMPATIBLE

FULL MESH NETWORKING

ISDN COMPATIBLE

EXTENSIVE AVAILABILITY OF REDUCED BANDWIDTH CHANNELS FOR VIDEOPHONES

SIGNIFICANT NUMBER OF CHANNELS AVAILABLE FOR FULL MOTION VIDEO

TARGET APPLICATIONS:

VOICE/VIDEO/DATA NETWORKS BETWEEN CORPORATE PLANTS AND OFFICES

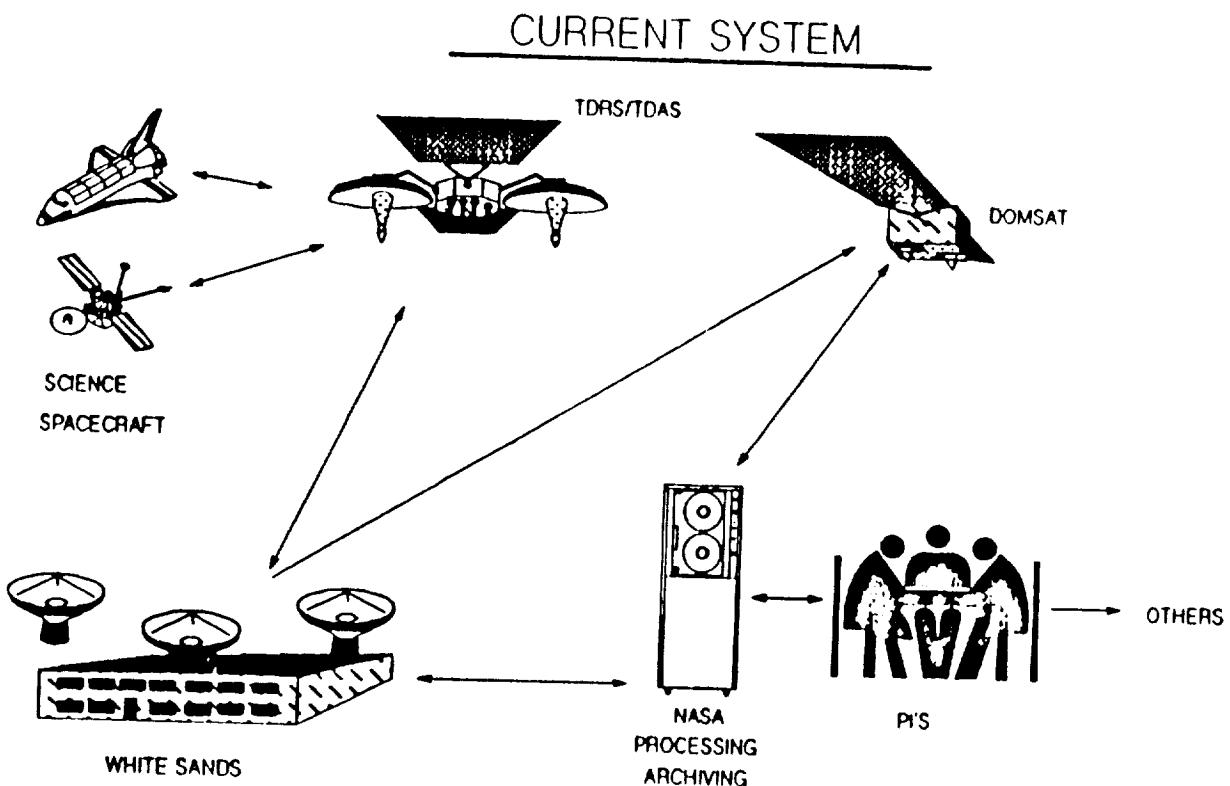
IMAGE DATA NETWORKING FOR COMMERCIAL AND SCIENCE USERS

CABLE TV INTERNETTING FOR DIRECT TO/FROM HOME VIDEOPHONE SERVICE

COMMUNICATION SATELLITES

INTRODUCTION

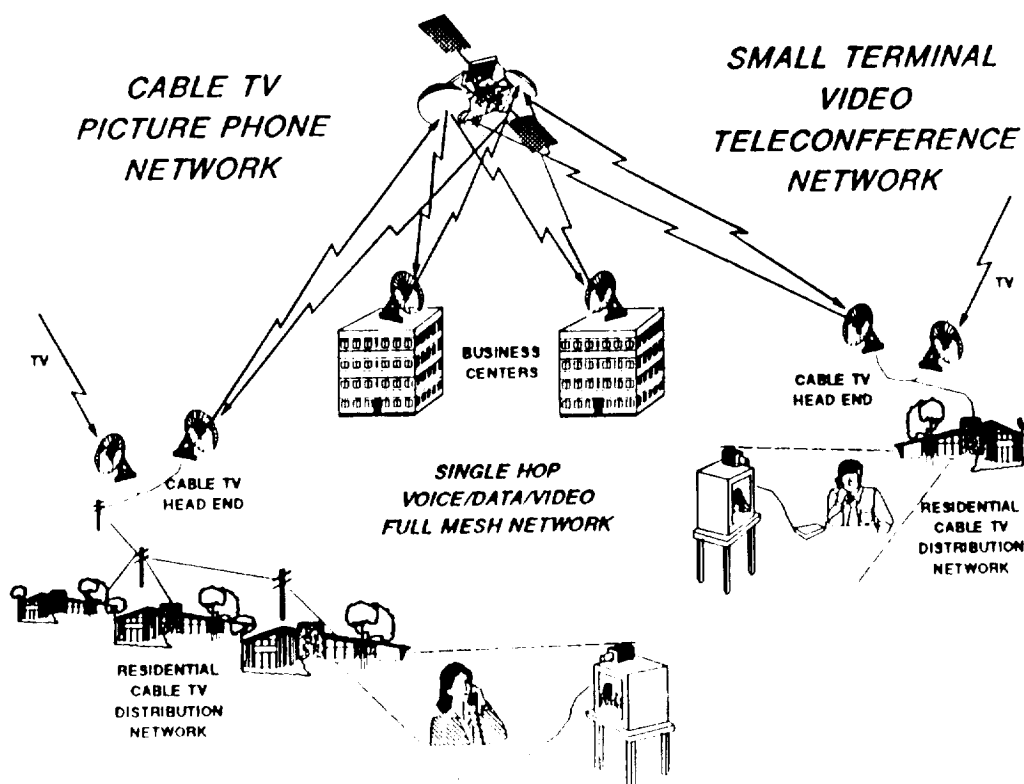
- 0 NASA INTRODUCED THE FIRST AND ONLY (AS OF NOW) PROFITABLE USE OF SPACE WHEN IT LAUNCHED THE FIRST COMMUNICATION SATELLITE IN 1963
- 0 SINCE THEN, THROUGH BOTH NASA AND INDUSTRY INNOVATION THE COMMUNICATION SATELLITE INDUSTRY HAS GROWN TO PROVIDE \$3.5 B/YR. IN REVENUES AND TO BE ONE OF MAJOR GLOBAL INFLUENCE
- 0 THE INFORMATION AGE IS MAKING NEW DEMANDS
- 0 TERRESTRIAL FIBER OPTICS IS BECOMING A COMPETITOR
- 0 NEW COMMUNICATION SATELLITE TECHNOLOGIES PROMISE TO MEET INCREASING DEMANDS AND ENABLE NEW SERVICES



COMMUNICATION SATELLITES

CONCLUSION

- o COMMUNICATION SATELLITES PLAYED KEY ROLE IN ENABLING INFORMATION ERA AND CREATING ONE GLOBAL COMMUNITY
- o NEW TECHNOLOGIES SUCH AS TERRESTRIAL FIBER OPTICS WILL COMPETE AND FORCE MARKET SHIFTS
- o NEW EMERGING INFORMATION AND COMMUNICATION NEEDS WILL INCREASE DEMAND
- o NEW MODULATION AND CODING TECHNOLOGIES WILL BE IN INCREASING DEMAND TO ENABLE AND ENHANCE THESE NEW SERVICES



COMMUNICATION SATELLITES

ADVANTAGES

- 0 EASE IN SETTING UP LINK
- 0 BROADCAST MODE
- 0 TRANSPORTABLE/MOBILE
- 0 DISTANCE INSENSITIVE

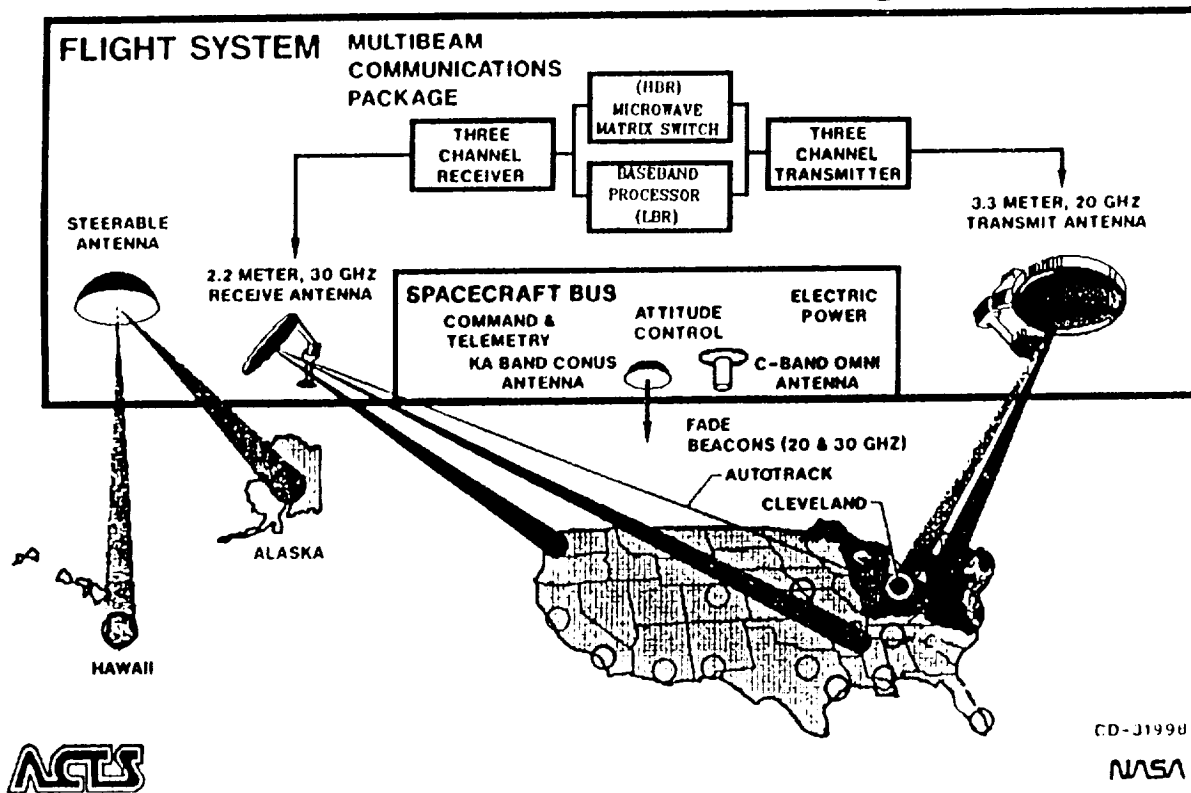
LIMITATIONS

- 0 BANDWIDTH
- 0 DELAY
- 0 PATH LENGTH

BENEFITS TO NASA

- 0 OFFERS SOLUTION TO NASA'S BURGEONING NEED FOR ADVANCED HIGHER CAPACITY TELECOMMUNICATIONS SYSTEMS TO SUPPORT FUTURE SHUTTLE, SPACE STATION, AND SCIENCE NEEDS.
- 0 WILL INFUSE STATE-OF-THE-ART SATELLITE TECHNOLOGY INTO NASA'S CONTINUED MODERNIZATION OF ITS INFORMATION SYSTEMS NETWORK.
- 0 GREATLY IMPROVED ACCESS BY PI'S AND OTHERS TO SPACE SCIENCE DATA, BOTH REAL-TIME AND ARCHIVED.
- 0 WILL ENABLE "SPACE" TO BECOME A PART OF EXPERIMENTER AND EDUCATOR'S LABORATORY OR CLASSROOM THROUGH TELEPRESENCE (MONITORING & CONTROL OF EXPERIMENTS).

Functional Overview of the ACTS Flight Segment



COMMUNICATION SATELLITES

BENEFITS OF NEW MODULATION AND CODING TECHNOLOGIES

- 0 CONSERVE BANDWIDTH
- 0 CONSERVE POWER
- 0 IMPROVE LINK AVAILABILITY
- 0 IMPROVE INFORMATION INTEGRITY
- 0 IMPROVE INFORMATION SECURITY

COMMUNICATION SATELLITES

CURRENT APPLICATIONS

- 0 TELEVISION PROGRAM DISTRIBUTION
- 0 LONG HAUL TELEPHONE
- 0 DATA TRANSMISSION
- 0 BUSINESS COMMUNICATIONS (STAR NETWORK)